



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

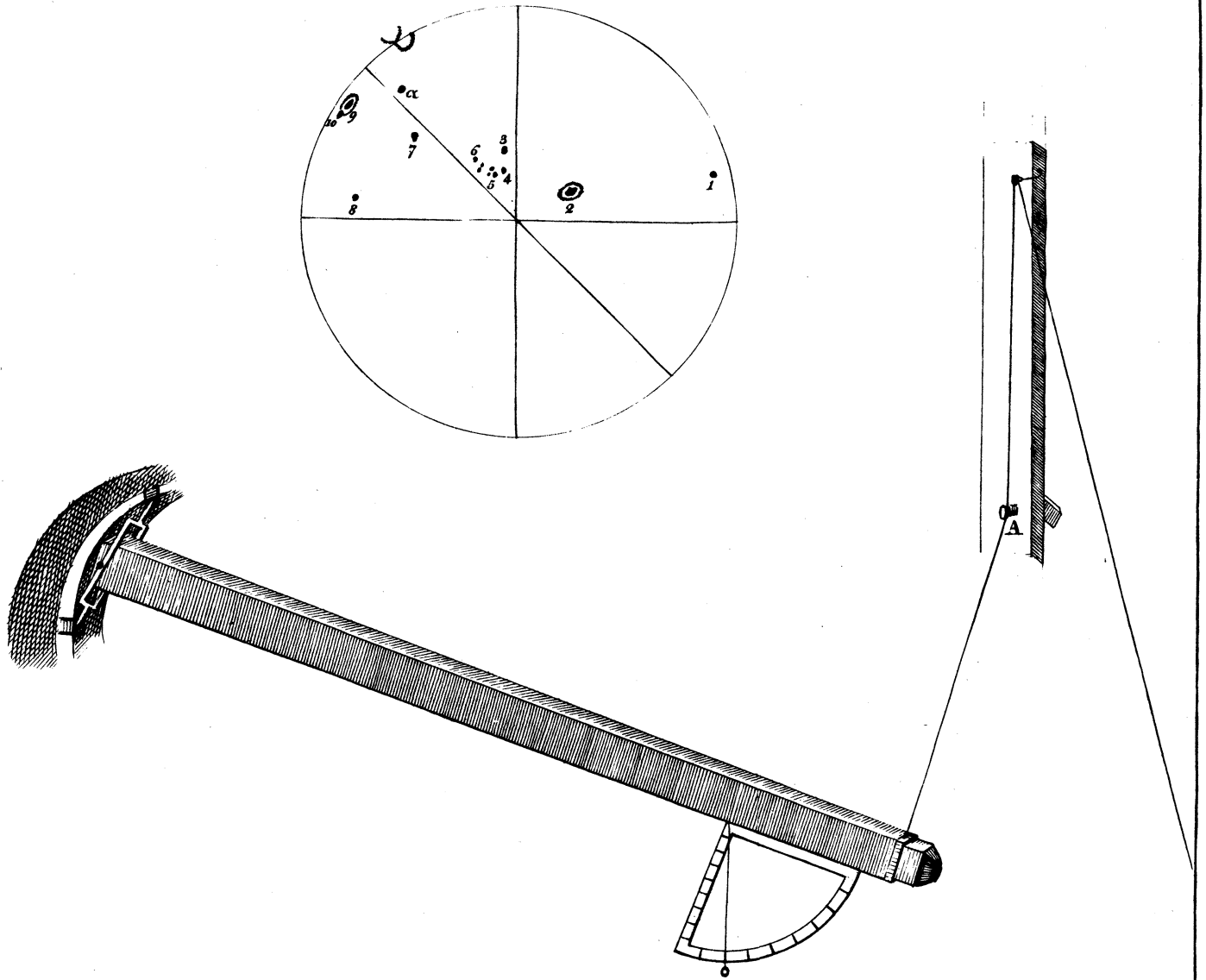
LVIII. *Observations of the Transit of Venus over the Sun, on June 3, 1769; and the Eclipse of the Sun the next Morning; made at East Dereham, in Norfolk, by the Rev. Francis Wollaston, F. R. S. Extracted from some Letters addressed to the Rev. Nevil Maskelyne, F. R. S. and Astronomer Royal.*

Read Dec. 21, 1769. **T**HE telescope I used was a reflector of Short's, of 12 inches focus, with a power that magnifies about 55 times. My clock was made by Holmes. It escapes dead seconds, has a pendulum with a wooden rod, and is firmly fastened to a stack of chimnies in the room where I observe. I had lately received it from London, and regulated it by transits of the Sun and stars, taken with a transit instrument of a peculiar kind (described at the end of this account); and also by equal altitudes of the Sun, taken with another instrument of my own make. By several transits of the Sun and fixed stars, observed in the latter end of May and the beginning of June, I found I had brought it to go at the rate of mean solar time very nearly, *i. e.* losing but 1'' in 14 days; and by transits of the Sun, it appeared to be 1'',5 too slow for mean time, on the third of June. But by a mean
of

of 8 days observations of equal altitudes, taken in June and the beginning of July, the clock appeared $5''.2$ slower than was found by the transit-telescope, which was not perfectly adjusted; though, as its error continued always the same, it was very sufficient for determining the rate of the going of the clock. Hence, on the day of the transit, the clock was $6''.7$ or $7''$ too slow for mean time; and the observations that follow are corrected accordingly.

In watching for the first contact of Venus, I kept my eye on the Sun's edge where the contact was expected; keeping that point nearly in the center of my field; and the first impression which I saw (without any penumbra or atmosphere that I could perceive) was at $7^h 12' 32''$ by my clock, or $7^h 12' 39''$ mean solar time. I looked particularly to see whether the rest of the Planet were visible while only part was on. If I saw that, it appeared as a portion of a larger circle: but I think I should not have observed it at all, if I had not looked for it. The dark part on the Sun did not appear to me with a smooth edge; and yet I could not discern any undulation in it: but the clouds obliged me to slide my smoked glasses so often, it interrupted me much. I then tried my strongest magnifying power of 110, but to no purpose; for there was an undulation on the Sun's edge, by that time, so great, that I thought it best to return to the former power of 55. Before the internal contact, at about $7^h 24'$, I lost the Sun entirely, and, though there were a few breaks in the clouds, he never appeared more that evening.

As to the eclipse the next morning, I saw that more perfectly; though at first there were many
flying



flying clouds; which, however, did not deprive me of any observation I was capable of making. It began here at $18^h 42' 17''$ by the clock, or $18^h 42' 24''$ mean time (a cloud had just passed; but I can be sure it was not visible $2''$ or $3''$ before); and it ended at $20^h 28' 1''$ by the clock, or $20^h 28' 8''$ mean time. I used the magnifying power 55, as I had done for the transit. As I have no micrometer, the best method I thought I could take to observe the phases of the eclipse, was by the immersions and emersions of the spots; which, if there were comparative observations in other places, might measure them better than any instruments I have. The scheme annexed shews the situation of the spots, as I judged of them by my eye; and the observations that follow refer to the numbers in the drawing, TAB. XVII. fig. 1.

Mean time.

h	'	''	
18	42	24	Beginning of the eclipse.
	44	37	Spot 1 immerses.
19	3	17	The nebula of spot 2 begins to immerge.
	4	47	Spot 2 quite immersed, but not the nebula.
	14	56	Spot 3 immerses.
	16	44	Spot 4 immerses.
	18	50	Spot 5 immerses,
	19	29	Spot 6 immerses.
	24	56	Spot 7 begins to immerge.
	25	22	Spot 7 immerses entirely.
	30	21::	Spot 1 immerses.
VOL. LIX.			G g g
			Mean

Mean time.

	h	'	"	
19	33	50		Nebula of spot 9 begins to immerge.
	34	14		Spot 9 begins to immerge.
	34	51		Spot 9 immerges entirely.
	35	3		Spot 10 immerges.
	42	31		Spot 8 immerges.
	45	8		Nebula of spot 2 begins to emerge.
	45	52		Spot 2 emerges entirely.
	46	57		Nebula of spot 2 emerges entirely.
	59	22		Spot 4 emerges.
20	0	10		Spot 5 emerges.
	1	38		Spot 3 emerges.
	4	50		Spot 6 emerges.
	11	35		Spot 8 emerges.
	24	53		Spot 9 emerges.
	26	22		Spot 10 emerges.
	28	8		The eclipse ends.

The spots α and N° 8 were not visible (or overlooked) on the Saturday morning, when I took a drawing of the others; but I think I may be sure were both seen that evening. The spot α certainly was not visible the next morning, though N° 8 and all the rest were: and, as far as I can recollect, that was its true situation. But, as the Sun did not break out till a few minutes before 7, and was quite gone before the internal contact, I had no opportunity to watch it. The roundness and blackness of that spot, at first suggested a suspicion of its being a satellite of Venus: but as this is not corroborated by any other accounts, it is probably a mistake. The two wires at
right

right angles to each other, express a horary circle, and a parallel of the equator (the telescope moving in the plane of the equator); and serve to shew the situation of the spots in general. The other is an oblique wire, the corresponding one having been taken out a few days before, in order to leave the field more clear.

As to my latitude, I have tried it different ways with such instruments as I have; but what I trusted to most, were the zenith distances I took of α Cephei and α Cygni at one time; and η and ζ Ursæ Majoris at another (for some nights successively) with my transit telescope; from which I suspend a plummet, at a certain distance from the quadrant underneath, one of whose radii becomes thereby a tangent; which being graduated, I calculate by it the distance of stars near the zenith, and correct the errors of collimation by taking them both ways. I have likewise taken stars both ways, with my equal altitude quadrant, which indeed is a very imperfect instrument for that purpose: but, by calculating the mean, it turns out much the same as by the other method, viz. $52^{\circ} 40' 20''$ north.

The other figure (2) is a sketch of my transit-telescope, which you enquired after. The principle it goes upon is this: the center of the object-glass remains immovable, while the telescope (by cross-axes at right angles to each other, which intersect at that center) hangs as it were from thence, and has a free motion every way; and particularly its motion east and west is freed, as much as possible, from friction. At the focus, where the cross wires are,

it is suspended by a smooth even catgut, by which that end is let down to the altitude required. This catgut bears constantly against a deep angular groove that is cut round the end of the screw marked A; by which means that end hangs always from the same point at all altitudes; from whence, the centre of gravity of the telescope keeps it constantly in the same plane. This screw runs east and west; and therefore, when the telescope is drawn up to a horizontal position, serves to adjust it to the meridian, by directing the wires to a distant mark. The settling of that meridian mark is certainly the same in this as in other transit-instruments; and perhaps mine is not exactly right. But I suspect my instrument errs in another particular; that the line of collimation does not run parallel to the intersection of cross axes and the center of gravity; which it ought to do. This is owing to bad workmanship, which a skilful operator could easily set right; and, when adjusted, I should think would not be apt to vary, but would always continue to describe a true vertical, as indeed it has proved upon trial; having always, in this rude form, kept to the same errors at the same altitudes.

The rest of the drawing, I believe, explains itself: excepting the two curved pieces of paste-board between which the telescope is directed; which are designed to keep off the air that would make it vibrate; and do in effect take off also a great deal of false light in the day time, and answer the purpose of an illuminator at night.

The

The thought occurred to me while I was using Lord Charles Cavendish's meridian line; to which you see I thus adapt a telescope; and there being fewer particulars necessary to be attended to, when once rectified, I thought it would be more serviceable in a common building, than those transit-instruments which require so very steady a foundation.

East-Dereham,
June and July, 1769.

Francis Wollaston.